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Information Systems Cybrarium

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Abstract

In what ways are advances in information technology likely to affect the processes of scientific research and publication? To study the issues we have developed a web-based knowledge management infrastructure which supports the creation, synthesis and application of scientific knowledge. The purpose of this paper is to present this infrastructure, which we call "Cybrarium", and to highlight core issues such as approaches for the organization of scientific knowledge and likely changes to established publishing processes in an electronic environment.

Introduction

Information technology has the potential to dramatically improve an organization's or a community's capability for knowledge management. These potentials have most significance in knowledge intensive industries and communities. Much effort, for example, currently is spent by consulting, high-tech and pharmaceutical companies to leverage IT for reinventing knowledge-intensive processes. Less dramatic change, however, is visible in the scientific community. On one hand, information technology has reduced communication barriers and simplified access to publications. Many academic institutions and some journals make their findings available on the internet - in some cases before they are published in traditional journals (Ginsparg, 1994). On the other hand, the processes of performing research, writing up results and publishing the results in reputable journals after detailed review have not (yet?) significantly changed. In addition, there seems to be widespread doubt whether they are likely to change at all.

Information systems research should be able to answer this question. We have argued elsewhere in detail that significant change is possible and necessary (El Sawy et al., 1997). However, to substantiate our argument and to further research the issue, we have begun the development of an electronic infrastructure which supports the management of scientific knowledge about information systems. In this paper, we present this infrastructure, which we call "Information Systems Cybrarium" as an effort to better understand the impact of design alternatives between electronic and paper-based environments. The Cybrarium currently is publicly accessible at http://cybrarium.usc.edu. Its user-interface supports multiple languages (currently English and German; Korean will be next). It consists of an internet server linked to a relational database which stores all knowledge and a separate email server.

The creation of a knowledge management infrastructure needs to address at least the following issues: how knowledge is to be organized and how users interact with knowledge. For both issues, we will compare paper-based and electronic approaches:

Organization of Knowledge

Paper has led to significant restrictions in the way that knowledge can be organized. A large amount of scientific knowledge is first published in journals. Each journal issue typically contains a collection of articles which, however, may have little in common besides the publishing date. Relationships between articles are often not made explicit and the creation of organized, detailed collections of knowledge concerning a specific topic is difficult and costly. The economics of paper also impose restrictions on the size of arguments published: Insights which can be conveyed in a paragraph or which require thousands of pages are difficult to publish. Therefore, in the current research process, the self-contained article stands out as the primary element of knowledge. This may change significantly in an electronic environment where all of these limitations can be overcome:

- Elimination of size restrictions: In the Cybrarium, no limitations are enforced on the size of a contribution.
- Bidirectional relationships: All contributions are stored in a database which generates web pages on the fly. In contrast to traditional web-sites this has the advantage that links between contributions are bidirectional: therefore it is possible to navigate directly from an earlier article to those which refined it, extended it, contradicted or referenced it in any other way.
- Meta structure for knowledge: Most important, however, is the additional flexibility in imposing multiple structures on the knowledge. Currently a distinction is made between different types of knowledge. Traditional articles which are collections of many thoughts are classified as GENERAL TEXT. A different class incorporates contributions concerning CONCEPTS. This class is used to synthesize knowledge concerning specific theories, variables and other core concepts which are relevant

in our domain. Texts, then, are related to the relevant concepts. This reduces the need for authors to create their own definitions and explanations of commonly used concepts (without preempting different views concerning a concept, however).

- Custom compilations of knowledge: We are currently working on a mechanism that allows users to create custom paths through the Cybrarium. This will allow users to easily compile knowledge in different ways.
- Prioritization of research problems: Several other classes of contributions are distinguished in the Cybrarium. An interesting class represents PROBLEMS which merit research. It allows researchers to submit descriptions of problems, which then can be evaluated, refined, prioritized by all members of the research community. This may also provide a better basis for dialogue with practice; it may reduce the risk of research being fitted to available methodologies rather than real-world problems (Dunnette, 1978).

These changes to the organization of knowledge may lead to several important changes to the research process: The contribution of a researcher will not necessarily take the form of customary articles with approximately 5000 words. Contributions may consist of the development of a network of relationships between existing nodes. They may consist of the resolution of apparent contradictions between variations of a concept or of the thorough definition and operationalization of a single concept which is used in many papers but has never been clearly articulated. They may also consist of the clear identification of a new problem –which can be a significant step to a solution. There is little doubt that these alternatives also require significant changes to the reward system.

Interaction

Support for interactive knowledge management is one of the key areas where information technology excels in comparison to paper. In a paper environment, responses, comments and annotations to a paper present significant problems. Annotation after publication is difficult and costly and will remain separated from the original text. A text can not be modified as new insights arise.

In an electronic environment, these problems do not exist:

- Instant update: Contributions to the Cybrarium are either stored in the Cybrarium database or in a location on the internet that is controlled by the author. An author can change a contribution stored in the Cybrarium easily by submitting an updated version. Contributions which are stored on the internet are under direct control of the author and therefore can be changed as easily.
- Annotation: The Cybrarium allows the reader to add their opinion in two forms: As comments or as rating. The comment option is similar to the format used in internet discussion groups.
- Collaborative filtering: The rating option minimizes the effort for the reader. With a maximum of three mouse-clicks a contribution can be evaluated on 7-point scales according to the criteria of relevance, detail and quality. These ratings are the basis for collaborative filtering (Konstan et al., 1997): when browsing through the Cybrarium, a reader can select to view only contributions which exceed a user-specified cutoff. A user may, for example, be interested in contributions which are highly relevant for a specific field. Another user may place more importance on academically rigorous contributions. Filters can also be based on combinations of ratings.
- Electronic notification: When a comment is added to an article stored in the Cybrarium, an email message is generated automatically to notify the authors. This increases the interaction between authors and readers.

This increased interactivity leads to a change in the role of the reader. While this is a traditionally passive role, in the Cybrarium the reader becomes more active. He may provide important additional insights, point out problems etc. which may be useful to the next reader. In addition a reader's action may determine what contributions will be presented to the next reader.

But the Cybrarium includes another significant change in interaction compared to traditional journals.

Instant publishing: In the Cybrarium, all contributions are immediately published. They are immediately accessible to the public. The mechanism of collaborative filtering ensures that this does not lead to information overload: contributions that are low in quality or relevance will be filtered out quickly by the system. In addition, contributions which have not yet been rated can be filtered out. The advantage of filtering is that it can be tuned to the needs of the reader. Someone who is surveying a narrow, highly-specialized topic may have different requirements concerning level of detail, relevance and rigor than someone who is interested in the general IS. Collaborative filtering is not the only mode for assessing the quality of contributions, however. We are currently working on additional functionality for the Cybrarium to support traditional peer-review. The paper and reviewer's comments will be posted without giving away the identity of the author. However, they will be instantly accessible to all readers of the Cybrarium. When a paper passes the review process, it subsequently is added to a special list of accepted contributions. Readers then can access the articles through the list. They can also use the acceptance criteria as part of their filter for browsing. The main function of review thus becomes the evaluation of a contribution and is separated from the publishing decision. This has interesting consequences: excellent papers may be endorsed by several virtual journals. Review can be much more flexible; it does not need to be restricted to a binary yes/no decision.
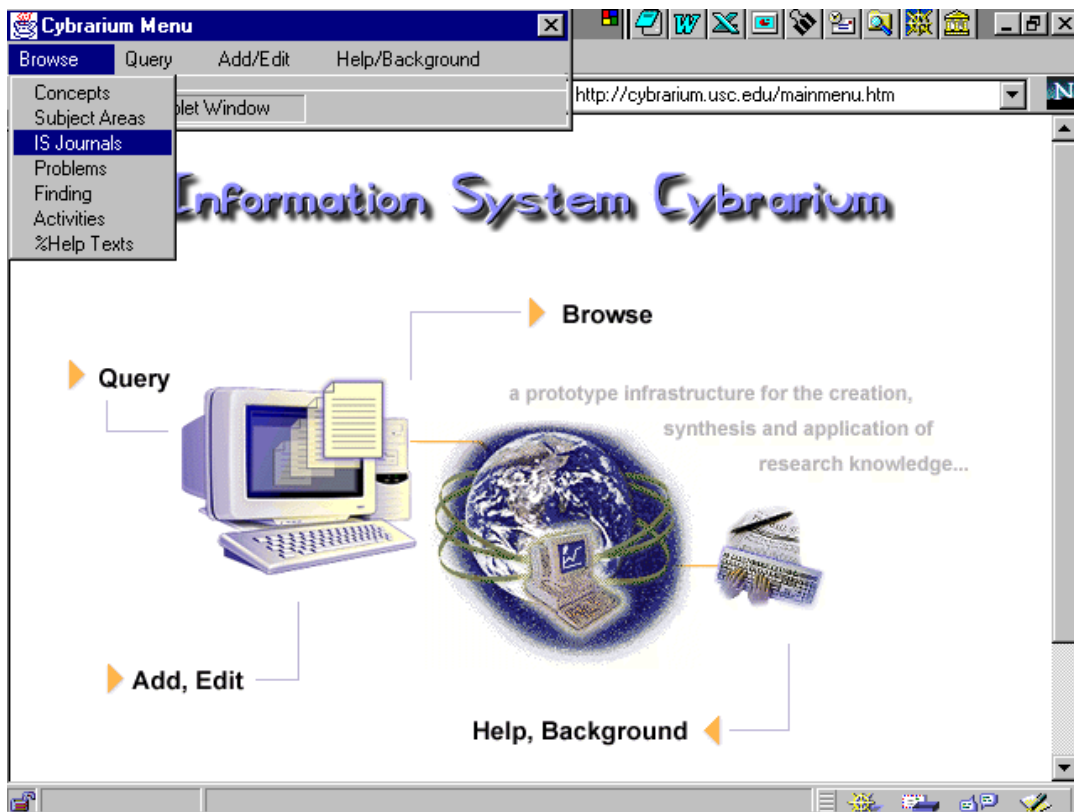
Figure 1. Cybrarium Main Menu (http://cybrarium.usc.edu)

Evolution Paths

The Cybrarium currently contains more than 1500 knowledge nodes. 8 faculty and PhD students currently are working on extending the seed knowledge. Among others, knowledge from all new articles in top information systems journals (CACM, MISQ, ISR) is being included. However, an infrastructure is only as good as the number of persons using it. Therefore the success the Cybrarium depends only in part on the underlying technology. The goal of our current research therefore is to test our approach, to attract and increasing audience for participation in the Cybrarium and to further develop its mechanisms. Many opportunities exist for building additional mechanisms to support the organization and synthesis of knowledge. Cluster analysis can be used to identify patterns in research approaches. Data mining techniques can be used to identify promising research areas. Techniques from AI, knowledge representation and linguistics can be used to identify overlaps, interdependencies and inconsistencies between different contributions. We hope to convince a larger part of the IS research community to share in our effort!

Demonstration Outline

The technology demonstration will focus on a typical working session with the Cybrarium. It will highlight innovations for the management of scientific knowledge which are possible in an electronic environment. First, a reader perspective will be adopted. Knowledge will be retrieved by utilizing query and navigation features based on the Cybrarium meta structure. Contributions that are stored both inside of the Cybrarium and externally will be retrieved. The advantages of collaborative filtering will be shown. Next, an author's perspective is adopted. A new paper will be added to the Cybrarium and integrated with the existing body of knowledge. This involves the creation of explicit links to existing theories, variables, findings etc. Finally, implications for the research community will be discussed.

References

Dunnette, M.: "Fads, Fashions, and Folderol in Psychology." In Dubin, R., *Theory Building*. New York, 1978, pp. 268-280.

El Sawy, O., et al.: "Reenginering Research for the 21st Century; From Cottage Craft to Community Cybrariums." IOM Working Paper, Univ. Southern California, 1996. http://www.usc.edu/dept/iom/paper/iom9602/cyb.htm.

Ginsparg, Paul: "Physics Preprint e-archive: First Steps Toward Electronic Research Communication." *Computers in Physics,* (8:4), Jul/Aug 1994, p. 390.

Konstan, J. et.al.: "GroupLens: Applying Collaborative Filtering to Usenet News." *Communications of the ACM* (40:3), 1997, pp. 77-87.